

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**APPLICATION FOR LETTERS PATENT**

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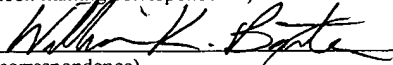
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LIFTING ASSEMBLY

BACKGROUND OF THE INVENTION

The present invention relates generally to piercing systems for raising and supporting building foundations and the like, and more particularly to a lifting assembly comprising a removable and reusable lifting bracket and a support bracket for raising and supporting a load.

Many types of building structures are supported by foundations that in turn are supported by soil rather than by more stable bedrock or other supporting strata. Shifting of the supporting soil over time can cause the foundation to sink, which can lead to various problems including structural damage. Unless the foundation is supported, further shifting can occur and worsen the structural damage. Furthermore, it is frequently desirable to raise the foundation to its original level in order to facilitate restoration of the structure to a proper condition.

In foundation piercing systems, the foundation of a structure is excavated down to the footings at each pier location, pilings are driven into the ground through unstable soils to rock or load bearing strata by hydraulic rams for lifting and stabilizing the foundation and preventing future settlement. A support bracket is attached to the foundation footings from below and raised by hydraulic rams for vertical adjustment of the foundation.

Many devices and methods have been developed for raising and supporting a foundation. Many such devices and methods employ piers that are driven into the ground adjacent an edge of the foundation until the piers encounter bedrock or other relatively firm supporting strata. Jacking devices are used for jacking up the edge of the foundation, using the piers for support. When the foundation is raised to the desired level, the foundation is affixed to the piers and the jacking equipment is removed.

In some such lifting devices, brackets are affixed to the foundation and are slidably engaged with the piers, and the jacking devices engage the brackets for raising the foundation. A bracket typically includes a pier-receiving portion such as a collar or sleeve that surrounds the pier in close-fitting fashion, and a support plate rigidly affixed to the pier-receiving portion and
5 configured to engage a lower surface of a foundation. The pier-receiving portion is sized to fit closely about the pier so that the bracket is able to slide upward and downward along the pier but is substantially prevented from moving in any other direction.

U.S. Patent No. 6,142,710 to Holland Jr. discloses a lifting assembly for raising and supporting an edge of a foundation that includes a lifting saddle slidably received over a pier that
10 is driven into the ground adjacent the edge of the foundation, a bracket supported by the lifting saddle and adapted to be affixed to and to support the foundation, and a jacking apparatus configured to be supported atop an upper end of the pier. The lifting saddle is connected to the jacking apparatus by threaded rods slidably received through the jacking apparatus. The bracket is pivotally connected to the lifting saddle such that the bracket can rock side-to-side, thus self-
15 aligning and remaining aligned with the foundation during a lifting operation. The bracket can also pivot about a vertical axis and can slide in a forward or rearward direction relative to the lifting saddle. The lifting saddle can pivot relative to the pier about a horizontal axis.

The prior art discloses lifting assemblies including a support bracket and a lifting bracket that are attached to a jacking apparatus for lifting a supporting a foundation. The support bracket
20 and lifting bracket are fixed components of a piercing system that are not removable or reusable. The present invention provides a lifting bracket that is removable from the support bracket, piercing pole and jacking apparatus and can be reused on other lifting assemblies.

SUMMARY OF THE INVENTION

The present invention provides a lifting assembly for raising and supporting a load. The lifting assembly preferably includes a one-piece, integral, removable and reusable lifting bracket and a support bracket for raising and supporting a load. The lifting bracket is preferably
5 removably attached to a jacking apparatus for pushing or pulling a piercing pole through the support bracket and into the ground. One end of the jacking apparatus is attached to the lifting bracket and the other end of the jacking apparatus is attached to an upper end of the pier.

The jacking apparatus preferably includes a support brace located above the lifting bracket. The support brace includes a circular sleeve that encircles the pier driving pole, two
10 support wings extending in opposite directions from the circular sleeve, and a pair of hydraulic rams oriented on either side of and running parallel to the pier driving pole, wherein hydraulic rams connect to respective wings of the lifting bracket and the support wings of the support brace.

The jacking apparatus preferably engages a tubular upper end portion of the pier or a
15 tubular extension added onto the upper end of the pier. The jacking apparatus includes a vertical portion adapted to be slidably received within the pier or pier extension and a support portion adapted to rest atop an upper end of the pier or pier extension. Alternatively, the jacking apparatus can be formed of a short tubular section that receives the upper end of the pier and the lifting bracket can slidably engage the pier below the short tubular section.

20 The pier driving pole preferably extends through the support bracket and lifting bracket of the lifting assembly. The lifting bracket is preferably removably attached to the pier and the support bracket. If the hydraulic rams are removed from the lifting bracket, the lifting bracket

may be removed from the pier and support bracket and reused on another lifting assembly. The support bracket remains attached to the load and the pier.

The lifting bracket of the lifting assembly is constructed to be removable from the support bracket and the pier. The removable lifting bracket is designed to fit around the support
5 bracket. The lifting bracket preferably includes a pair of spaced-apart L-shaped lifting members, a pair of semi-circular convex members attached to the rear of the spaced-apart L-shaped lifting members, a pair of horizontal bracing members attached to the rear of the spaced-apart L-shaped lifting members and between the semi-circular convex members, and a pair of vertical bracing members extending between the pair of horizontal bracing members. An opening is formed
10 between the spaced-apart L-shaped lifting members, the convex members and the horizontal bracing members is designed to fit around a tubular member of the support bracket. This opening is sized slightly larger than the tubular member such that the lifting bracket can be removed from the support bracket. The removable lifting bracket can thus be used over and over again on adjacent piers and on other lifting assemblies.

15 The support bracket of the lifting assembly is constructed to be installed on the pole of a piercing system and engage the edge of a load thereon. The support bracket generally includes a tubular member for receiving the pole of a piercing system therein, an L-shaped member attached to the tubular member for supporting a load thereon, and a substantially horizontal top member attached on top of the tubular member and having an opening extending therethrough for
20 receiving the top of the tubular member therein.

The present invention can be utilized on single or double piercing systems having various push/pull configurations. The present invention also contemplates methods of employing same

for the purpose of raising and supporting a load, wherein the lifting bracket is removable from the support bracket and the pier, such that the lifting bracket may be reused on adjacent piers and on other lifting assemblies of a piercing system.

Various other features, objects, and advantages of the invention will be made apparent to those skilled in the art from the following drawings and detailed description of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1A is a front perspective view of a lifting bracket of the lifting assembly of the present invention;

FIG. 1B is a rear perspective view of the lifting bracket of FIG. 1A;

FIG. 2A is a front perspective view of a support bracket of the lifting assembly of the present invention;

FIG. 2B is a rear perspective view of the support bracket of FIG. 2A;

FIG. 3A is a front plan view of the lifting bracket and the support bracket attached to the piercing system comprising an embodiment of a lifting assembly of the present invention;

FIG. 3B is a side plan view of the lifting assembly of FIG. 3A;

FIG. 3C is a detailed perspective view of the lifting assembly of FIGS. 3A and 3B;

FIG. 3D is a cross-sectional view of the lifting bracket and the support bracket attached to the piercing system of the lifting assembly of the present invention;

FIG. 4A is a side plan view of the lifting bracket and the support bracket attached to the piercing system and supporting a slab comprising another embodiment of a lifting assembly of the present invention;

FIG. 4B is a front plan view of the lifting assembly of FIG. 4A;

5 FIG. 4C is a detailed front plan view of the lifting assembly of FIGS. 4A and 4B;

FIG. 4D is a cross-sectional view of the lifting bracket and the support bracket attached to the piercing system of the lifting assembly of the present invention;

FIG. 5A is a front plan view of the lifting bracket and the support bracket attached to the piercing system and supporting a slab comprising yet another embodiment of a lifting assembly of
10 the present invention;

FIG. 5B is a side plan view of the lifting assembly of FIG. 5A;

FIG. 5C is a rear plan view of the lifting assembly of FIGS. 5A and 5B;

FIG. 6A is a perspective view of the lifting bracket and the support bracket attached to the piercing system and supporting a slab comprising still another embodiment of a lifting
15 assembly of the present invention;

FIG. 6B is a front plan view of the lifting assembly of FIG. 6A; and

FIG. 6C is a side plan view of the lifting assembly of FIGS. 6A and 6B.

DETAILED DESCRIPTION OF THE INVENTION

Referring now to the drawings, FIGS. 1A and 1B illustrate a preferred embodiment of a lifting bracket 10 in accordance with the present invention. The one-piece, integral, reusable and removable lifting bracket 10 preferably includes a pair of spaced-apart L-shaped lifting members 12, 14, the lifting members 12, 14 having a pair of lifting wings 16, 18 formed on opposite sides thereof and a pair of support arms 20, 22 extending perpendicularly from the lifting wings. The lifting wings 16, 18 having a plurality of holes 24 extending therethrough for attachment to one end of a jacking apparatus and the lifting arms 20, 22 having a portion cut-out therefrom and a projection 26 extending upwardly from the top surface of each lifting arm at the ends thereof for receiving an L-shaped support bracket thereon.

The lifting bracket 10 further includes an upper semi-circular convex member 28 attached to the rear of the lifting wings 16, 18 and connected between the spaced-apart opening between the lifting members 12, 14, a first horizontal bracing member 30 attached to the rear of the lifting wings 16, 18 below the upper convex member 28 and connected between the spaced-apart opening between the lifting members 12, 14, a second horizontal bracing member 32, spaced-apart from the first horizontal bracing member 30, attached to the rear of the lifting wings 16, 18 above a lower convex member 34 and connected between the spaced-apart opening between the lifting members 12, 14, a lower semi-circular convex member 34 attached to the rear of the lifting wings 16, 18 and connected between the spaced-apart opening between the lifting members 12, 14, and a pair of spaced-apart parallel vertical bracing members 36, 38 connected between the first and second horizontal bracing members 30, 32. The vertical bracing members 30, 32 each having an opening 40 extending therethrough.

The lifting members 12, 14, convex members 28, 34, and bracing members 30, 32, 36, 38, collectively define a tubular-receiving opening through which a tubular member can be received therein. The tubular-receiving opening formed between the spaced-apart L-shaped lifting members 12, 14, the convex members 28, 34, and the horizontal bracing members 30, 32 is designed to fit around a tubular member of the support bracket. This opening is preferably large enough to accommodate the diameter of the tubular member of the support bracket therein and sized slightly larger than the tubular member such that the lifting bracket can be removed from the support bracket.

FIGS. 2A and 2B illustrate a preferred embodiment of a support bracket 50 in accordance with the present invention. The support bracket 50 is preferably constructed to be installed on the pole of a piercing system and engage the edge of a load thereon. The support bracket 50 includes a tubular member 52 for receiving the pole of a piercing system therein, an L-shaped support member 54 attached to the tubular member 52 for supporting a load thereon. The support member 54 having a generally horizontal portion 56 adapted to engage a lower surface of the edge of a load, the generally horizontal portion 56 having a pair of openings 60 extending therethrough for receiving the projections 26 of the support arms 20, 22 of the lifting members 12, 14 therein when the lifting bracket 10 is positioned around the support bracket 50, and a generally vertical portion 58 extending perpendicular from one side of the horizontal portion 56.

The support bracket 50 further includes a top member 42 attached to the top of the tubular member 52 and extending perpendicular from the top of the vertical portion 58 having an opening 44 extending therethrough for receiving the tubular member 52 therein, a vertical alignment member 46 extending outwardly from the tubular member 52 opposite the support member 54 having an opening 48 extending therethrough, an angle bracing member 62 attached

between the tubular member 52 and the bottom of the horizontal portion 56, an alignment pin 64 attached to the bottom of the angle bracing member 62 for aligning and supporting the lifting bracket 10 around the support bracket 50, and a plurality of lateral bracing members 64 for bracing the support member 54 and top member 42 to the tubular member 52.

5 FIGS. 3A, 3B, 3C and 3D illustrate various views of an embodiment of a lifting assembly 70 in accordance with the present invention. The lifting assembly 70 includes a lifting bracket 10 and a support bracket 50 attached to a piercing system jacking apparatus 72. One end of the jacking apparatus 72 is attached to the lifting bracket 10 and the other end of the jacking apparatus 72 is attached to an upper end of a piercing pole 74 for pulling or pushing the piercing
10 pole 74 through the support bracket 50 to raise or lift a load. The embodiment shown in FIGS. 3A, 3B, 3C and 3D is an example of a pulling piercing system.

 The jacking apparatus 72 preferably includes a support brace 76 located above the lifting bracket 10. The support brace 76 preferably includes a circular sleeve 78 that encircles and slidably receives the piercing pole 74 or a tubular extension added onto the upper end of the pole,
15 two support wings 80, 82 extending in opposite directions from the circular sleeve 78, and a pair of hydraulic rams 84, 86 oriented on either side of and running parallel to the piercing pole 74 that are fastened to respective lifting wings 16, 18 of the lifting bracket 10 and support wings 80, 82 of the support brace 76.

 FIG. 3D illustrates the details of the lifting assembly 70. The piercing pole 74 preferably
20 extends through the tubular member 52 of the support bracket 50 of the lifting assembly. The lifting bracket 10 is removably attached around the outside of the support bracket 50. The support bracket 50 is preferably supported on the lifting arms 20, 22 of the lifting bracket 10.

The horizontal portion 56 of the support bracket 50 preferably rests upon the projections 26 and lifting arms 20, 22 of the lifting bracket. The projections 26 extending from the top of the lifting arms 20, 22 are preferably inserted into the openings 60 in the horizontal portion 56 of the support member 54 of the support bracket. The top member 42 of the support bracket 50 extends
5 over the top of the lifting bracket 10. The vertical alignment member 46 of the support bracket 50 extends between the pair of spaced-apart parallel vertical bracing members 36, 38 of the lifting bracket.

FIGS. 4A, 4B, 4C and 4D illustrate various views of the lifting bracket and the support bracket attached to the piercing system shown in FIGS. 3A, 3B, 3C and 3D, but supporting a load.
10 The only difference between FIGS. 3A, 3B, 3C and 3D and FIGS. 4A, 4B, 4C and 4D is that a load 88 is shown being supported by the horizontal 56 and vertical 58 portions of the L-shaped support member 54 of the support bracket.

The support bracket 50 is preferably constructed to be installed on the pole 74 of a piercing system and engage the edge of a load 88 thereon. The L-shaped support member 54
15 includes a generally horizontal portion 56 adapted to engage a lower surface of the edge of a load 88, and a generally vertical portion 58 extending perpendicular from one side of the horizontal portion 56 adapted to engage a vertical surface of the edge of the load 88. The alignment pin 64 attached to the bottom of the angle bracing member 62 of the support bracket 50 aligns and supports the lifting bracket 10 around the support bracket. The lifting bracket 10 is configured to
20 support the support bracket 50 such that upward movement of the lifting bracket 10 causes the support bracket 50 to lift the load 88.

FIGS. 5A, 5B and 5C illustrate various views of the lifting bracket and the support bracket attached to a piercing system comprising another embodiment of a lifting assembly supporting a load in accordance with the present invention. The embodiment shown in FIGS. 5A, 5B and 5C is another embodiment of a pulling piercing system in accordance with the present invention. The difference between the pulling piercing system shown in FIGS. 4A, 4B, 4C and 4D and the pulling piercing system shown in FIGS. 5A, 5B and 5C is the jacking apparatus.

The lifting assembly 90 includes a lifting bracket 10 and a support bracket 50 attached to a piercing system jacking apparatus 92. One end of the jacking apparatus 92 is attached to the lifting bracket 10 and the other end of the jacking apparatus 92 is attached to an upper end of a piercing pole 94 for pulling or pushing the piercing pole 94 through the support bracket 50 to raise or lift a load 96.

The jacking apparatus 92 preferably includes a support brace 98 located above the lifting bracket 10. The support brace 98 preferably includes a circular sleeve 100 that encircles and slidably receives the piercing pole 94 or a tubular extension added onto the upper end of the pole, two support wings 102, 104 extending in opposite directions from the circular sleeve 100, and a pair of hydraulic rams 106, 108 oriented on either side of and running parallel to the piercing pole 94 that are fastened to respective lifting wings 16, 18 of the lifting bracket 10 and support wings 102, 104 of the support brace 98. The difference in the jacking apparatus 92 of FIGS. 5A, 5B and 5C is that the hydraulic rams 106, 108 are inverted from the hydraulic rams 84, 86 of the jacking apparatus 72 shown in FIGS. 3A, 3B, 3C, 3D, 4A, 4B, 4C and 4D.

FIGS. 6A, 6B and 6C illustrate various views of the lifting bracket and support bracket attached to the piercing system comprising yet another embodiment of a lifting assembly

supporting a load in accordance with the present invention. FIGS. 6A, 6B and 6C show an embodiment of a pushing piercing system that lifts a load by pushing a piercing pole into the ground.

5 The lifting assembly 110 includes a lifting bracket 10 and a support bracket 50 attached to a piercing system jacking apparatus 112. One end of the jacking apparatus 112 is attached to the lifting bracket 10 and the other end of the jacking apparatus 112 is attached to an upper end of a piercing pole 114 for pushing the piercing pole 114 through the support bracket 50 and into the ground to raise or lift the load 116.

10 The jacking apparatus 112 preferably includes an upper support brace 118 located above the lifting bracket 10. The support brace 118 preferably includes an opening 120 extending therethrough for slidably receiving the piercing pole 114 or a tubular extension added onto the upper end of the pole, a hydraulic ram assembly 120 attached to the bottom of the support brace 118 including a pair of hydraulic rams 122, 124 oriented on either side of and connecting to the piercing pole 114, and a pair of lateral braces 126, 128 oriented on either side of the hydraulic
15 rams 122, 124 and running parallel to the hydraulic rams 122, 124 that are fastened to respective lifting wings 16, 18 of the lifting bracket 10 and the support brace 118.

Operation of the lifting assembly includes excavating the foundation of a structure down to the footings, installing a piercing system along the foundation in order to lift a settled foundation, attaching a lifting assembly and a jacking apparatus to the piercing system, attaching a
20 support bracket of the lifting assembly to the foundation footings, driving a piercing pole into the ground through unstable soils to rock or load bearing strata for lifting and supporting the foundation on the support bracket, removing the jacking apparatus from the lifting assembly,

removing the lifting bracket from the lifting assembly leaving only the support bracket and the piercing pole, cutting off the piercing pole and anchoring the top of the pole to the support bracket, and using the removed lifting bracket on other lifting assemblies or piercing systems.

The lifting assembly of the present invention includes various accessories, such as, a foot
5 for insertion into the bottom of the piercing pole, a plug for insertion into the bottom of the
piercing pole, a coupling for connecting sections of the piercing pole together, various lengths of
drive pipe for driving the piercing pole into the ground, a piercing pole guide bushing, and a shim
plate.

While the invention has been described with reference to preferred embodiments, those
10 skilled in the art will appreciate that certain substitutions, alterations and omissions may be made
to the embodiments without departing from the spirit of the invention. Accordingly, the
foregoing description is meant to be exemplary only, and should not limit the scope of the
invention.